UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/528,262	03/17/2000	Steven P. Den Baars	585-27-009	4221

7590 05/03/2002

Koppel & Jacobs
555 St Charles Drive
Suite 107
Thousand Oaks, CA 91360

EXAMINER
BAUMEISTER, BRADLEY W

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 05/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
09/528,262	Denbaars et al.
Examiner	**Art Unit**
B. William Baumeister	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Feb 20, 2002*

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-9, 14-16, 18, and 24-51* is/are pending in the application.

4a) Of the above, claim(s) *48-51* is/are withdrawn from consideratio

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-9, 14-16, 18, and 24-47* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Mar 17, 2000* is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Election/Restriction

1. Applicant's election of Species I in Paper No. 13 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following features must be shown or canceled from the claim(s). No new matter should be entered.

a. (Claim 42) A substrate doped with iron (Fe) as well as Cr, Ti and Co.

b. (Claims 30-47) Two pairs of oppositely doped (clad) layers, respectively sandwiched between two active layers. The drawings only show embodiments wherein plural active layers are sandwiched between a single pair of oppositely doped clads (e.g., FIGs 3, 4), or alteratively (FIG 2) one active layer sandwiched between n and p clads with the rest sandwiched between p clads (not oppositely doped).

Claim Objections

3. Claims 2, 25-29, 37 and 41 are objected to because of the following informalities. Appropriate correction is required.

a. Claim 2, line 5 recites "at a predetermined wavelength is [sic: in] response to..."

b. Regarding claims 25-29, claim 25, line 4 recites, "a pair of oppositely doped layer [sic: layers].

c. Regarding claim 37, while there is nothing technically wrong with the wording of the claim, it raises the following question: the claim sets forth that "the light emitting from the device comprises the light emitting from at least one of said active layers or ... at least one of said active layers in combination with the light emitted from said doped substrate." (Underline added) In that the goal of the invention is to produce secondary re-emission from the doped substrate with or without external emission of the primary light source, the Examiner questions whether the claim was, in fact, intended to read "the light emitting from the device comprises the light emitting from at least one of said doped substrate or ... at least one of said active layers in combination with the light emitted from said doped substrate."

d. Claim 41, last two lines recite, "it absorbs...and re-emit [sic: re-emits] more than one color of light."

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 30-47 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

a. Claim 30 sets forth:

> "...at least two active layers;
> at least two pairs of oppositely doped layers, each of said active layers sandwiched between one of said pairs of oppositely doped layers..."

The specification discloses embodiments having plural active layers wherein these active layers are sandwiched between a single pair of oppositely doped clads (Figs 3, 4), or alternatively (FIG 2) wherein one active layer is sandwiched between n and p clads with the rest sandwiched between p clads (not oppositely doped). The specification as originally filed does not disclose plural pairs of oppositely doped layers, and the inclusion in the claims constitutes new matter.

b. Claims 32 and 44 each further recites two pairs of electrical contacts. The specification discloses and depicts embodiments wherein each active layer/region has its own p-side electrical contact, but all of the embodiments have a common n-side electrical contact. The

specification as originally filed does not disclose at least two pairs of electrical contact, so this limitation constitutes new matter.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-9, 14-16, 18, 24-29, 38 and 39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claim 1 recites a light emitting device (not an LED) comprising a light emitting diode (LED) formed on a doped substrate. The substrate--not the LED--re-emits light of a second wavelength. However, claim 1 then goes on to recite, "said LED emitting a combination of light from said substrate and said active layer." The language renders the claims indefinite as to whether the light emitting device includes an LED formed on a substrate, or alternatively whether the LED includes the substrate.

b. Similarly, claim 25 sets forth a method of generating light from a light emitting device, comprising disposing an LED on a doped substrate, but then recites "transmitting a combination of said optical emission and substrate emission as said LED's light. The language renders the claims indefinite as to whether the light emitting device includes an LED formed on a substrate, or alternatively whether the LED includes the substrate.

c. Regarding claims 2 and 16, claim 2 recites the limitation "comprising at least one said active layers [sic: layer]... said active layers between two oppositely doped layers... and said substrate absorbs at least some of said light from at least one of said active layers..." (Underline added) It is unclear whether the claim reads on a device having one active layer or whether the claim requires at least two active layers. If the claim is intended to require at least two active layers, the examiner suggests amending the claim to read "comprising at least two said active layers..." or something similar.

d. Claims 38 and 39 set forth that the LED active layers emit blue, green and UV and that the doped substrate re-emits red, but then states "said LED emitting blue, green, UV and red light." Thus, it is unclear whether one of the LED active layers is required to also emit red light or if the claim covers those structures wherein red light is only emitted from the substrate.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

9. Insofar as definite, claims 1-9, 14-16, 18 and 24-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Kaneko '901. Kaneko discloses various III-N LED and LD emitters formed on doped semiconductor substrates for absorption of a primary wavelength in the range of 400-550 nm (UV-yellow) for III-N materials (col. 4, line 23; col. 5, line 7), and re-emission of a second wavelength from the doped substrate which is different/longer than that emitted from the primary LED source. The emitter may emit more than one wavelength (col. 10, lines 11-15). These wavelengths may or may not include the wavelength of the pumping light (the light that pumps the substrate activator centers) (col. 10, lines 29-36). The semiconductor substrate may be of various materials including sapphire (col. 3, lines 10-15). Various dopants or activators may be employed including Cr, Ti and Co (col. 3, line 15). The substrate may be uniformly or non-uniformly doped and a plurality of dopants can be utilized (col. 3, lines 15-20). Various wavelengths including white light can be selectively generated (col 3, lines 45-50; col. 10, lines 30-36). and col. 3

a. Regarding the claims setting forth that the LED emits UV or yellow, Applicant has defined UV as including 400-420 nm (specification, page 5, line 2) and yellow as including 550 nm (specification, page 8, line 4). These wavelengths are disclosed as explained above.

b. Regarding claims 16 and 18, Kaneko discloses that the optical crystal substrate may include a plurality of dopants and may be uniformly or non-uniformly doped (col. 3, lines 15-20). Kaneko further teaches that the electroluminescent light source can be configured to emit more than two wavelengths (multiple active layers) which may or may not include the wavelength

of the pumping light, and that these different wavelengths may be used independently (selectively) (col. 10, lines 30-45).

10. Insofar as definite, claims 1-8, 14, 16, 18, and 24-29 are rejected under 35 U.S.C. 102(b) as being anticipated by JP '203. JP '203 discloses UV-emitting (250-410 nm), III-N double-heterojunction LEDs formed on doped substrates that absorb the UV and re-emit various other colors including red, green and blue. Examples of substrates include Cr-doped sapphire. Paragraph [0013] states that the brightness of red, green and blue pixels (separate color centers) may be individually adjusted and balanced for full-color displays. A JPO computer translation is included for applicant's reference.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 30-37, 41 and 43-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko 901 as applied to the claims above, and further in view of Chen '681.

a. Kaneko discloses all of the limitations as explained above (including that the substrate may have a plurality of dopants and that it may be uniformly or non-uniformly doped (col. 3, lines 15-20), except for the limitation in claim 30 that at least two active layers are respectively sandwiched between at least two pairs of oppositely doped layers.

b. Chen teaches a plurality of blue or UV emitting LEDs which are arrayed on a common substrate. Each LED is sandwiched between a pair of oppositely doped clads with an associated pair of electrical contacts. Downconverting phosphors films are applied to the surface of the substrate for B, G, R emission (see e.g., FIGs 4 and 6).

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the Kaneko device by employing a plurality of LEDs as taught by Chen on the doped substrate structures of Kaneko for various purposes such as to provide independent control of which LEDs are activated for better color control in those embodiments wherein the multiple dopants are nonuniformly doped or for selective lighting of portions of a white display in those embodiments wherein the substrate in uniformly doped.

13. Insofar as definite, claims 30, 31, 33-37, 41, 43, 45 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko '901 as applied to the claims above, and further in view of Bojarczuk, Jr. et al '185.

a. Kaneko discloses all of the limitations as explained above (including that the substrate may have a plurality of dopants and that it may be uniformly or non-uniformly doped

(col. 3, lines 15-20), except for the limitation in claim 30 that at least two active layers are respectively sandwiched between at least two pairs of oppositely doped layers.

b. Bojarczuk teaches a plurality of blue or UV emitting LEDs which are arrayed on a common substrate. Each LED is sandwiched between a pair of oppositely doped clads. Downconverting organic films are applied to the surface of the substrate for B, G, R emission (see e.g., FIGs 6-8).

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the Kaneko device by employing a plurality of LEDs as taught by Chen on the doped substrate structures of Kaneko for various purposes such as to provide independent control of which LEDs are activated for better color control in those embodiments wherein the multiple dopants are nonuniformly doped or for selective lighting of portions of a white display in those embodiments wherein the substrate in uniformly doped.

d. Regarding claim 47, Bojarczuk additionally teaches (see FIG 8) a Si common substrate 86 with device drivers (integrated electrical circuitry). It would have been obvious to one of ordinary skill in the art at the time of the invention to have included within the Kaneko device a common substrate with integrated electrical circuitry as taught by Bojarczuk for the purpose of better integrating the device's components.

14. Insofar as definite, claims 9 and 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '203 as applied to the claims above, and further in view of Kaneko '901 as applied to the claims above.

a. Regarding claim 9, JP '203 discloses UV-emitting LEDs but does not appear to disclose yellow emitting LEDs. Regarding claim 15, JP '203 discloses that Cr and Ti may be used as dopants for obtaining R/G/B displays, but does not expressly disclose that Co may specifically be used as a dopant. Further the computer translation is unclear as to whether the dopants may all be provided uniformly throughout the substrate.

b. Kaneko discloses that yellow emitting III-N LEDs may be used in conjunction with Cr-doped sapphire to produce a secondary red light and that Cr, Ti, Co doped sapphire may be employed with UV LEDs to produce R/G/B secondary light. Kaneko further teaches that the doping centers may be localized or uniformly distributed. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed within the JP '203 device, (1) a yellow-emitting InGaN LED as taught by Kaneko for the purpose of obtaining an orange light; or (2) include a Co dopant within the substrate as taught by Kaneko, depending only on conventional considerations such as the cost and availability of the specific dopants or doped substrates and on the specific effective emission spectrum desired.

15. Insofar as definite, claims 38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over either one of Kaneko--Bojarczuk or alteratively Kaneko--Chen as applied to the claims above, and further in view of Thompson et al. '489.

a. Kaneko '901 teaches an LED that emits a primary wavelength selectable between UV to yellow. This primary light source is absorbed by dopant centers in a substrate that produce secondary light emission of one or more various desired colors having a longer wavelength(s) than the primary light (e.g., blue to red). The substrate dopants (or downconversion centers) may either be uniformly or nonuniformly distributed. Kaneko does not teach (1) primary light sources of plural LEDs having oppositely doped clads and associated pairs of electrical contacts, nor (2) multicolor-emission LED primary light sources.

b. Bojarczuk and Chen each teach primary light sources of LED arrays having oppositely doped clads and associated pairs of electrical contacts. The LEDs of these references also emit a single color from the primary light source and produce multicolor emission by the provision of various secondary downconversion layers. The references do not teach multicolor-emission LED primary light sources.

c. Thompson '489 teaches arrays of double heterojunction (DH) OLED-stack primary light sources wherein each LED stack has two active layers 102, 104 respectively emitting two colors (e.g., R/B or G/B). One skilled in the art would have readily understood at the time of the invention that a DH OLED generally functions analogously to a DH inorganic LED (having oppositely doped clad layers). A downconversion layer 106 is formed in alignment

with one of the LED stacks (nonuniformly distributed) so that primary light from the one stack will be absorbed and re-emitted as a secondary, longer wavelength (e.g., G or R).

d. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the LED-array primary light sources with doped-substrate downconversion layers as taught by either one of Kaneko-Bojarczuk or Kaneko-Chen so as to include multicolor-emission LED stacks as taught by Thompson for the purpose of providing a full color display while simultaneously providing increased color control independence, reduced electrode requirements and smaller area requirements as taught by Thompson (e.g., col. 2).

e. Further, the above combination of references does not expressly recite the specific colors set forth in claims 38-40 for the primary and secondary lights. Nonetheless, the references teach all of the underlying principles. As such, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide any specific single or multiple primary light source(s) that emit from UV to yellow in combination with a substrate having any specific single or multiple dopant(s) that re-emit from blue to red depending only upon the specific lighting or display application intended and the specific resultant color(s) desired.

16. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over either one of Kaneko--Bojarczuk or alteratively Kaneko--Chen as applied to the claims above, and further in view of Birkhahn et al. '669. Kaneko discloses that the substrate may be doped with combinations of various rare earth or transition metal impurities including but not limited Cr, Ti

and Co. However, Kaneko does not expressly state that iron is one of the impurities that may be employed.

Even assuming *arguendo* that it was not well known to those of ordinary skill in the art at the time of the invention independent of the Birkhahn teachings that iron impurities in substrates such as sapphire would emit blue light upon being activated by a UV light source, Birkhahn teaches that wide band gap semiconductor substrates doped with elements with partially filled inner shells such a rare earth elements and transition metals (e.g., Fe) can be formed and will emit in the visible and UV spectrum at a wide range of temperatures (col. 1, lines 40-). Given this disclosure, it would not require undue experimentation for one skilled in the art to determine the specific color emitted by each of the transition metals under these circumstances, and thereby determine that Fe emits a blue light. Accordingly, it would have been obvious to one of ordinary skill in the art at the time of the invention to further include iron impurities in the substrate for any of various purposes such as for altering the resultant hue of the blue emitted by the substrate, or for supplementing the blue-emitting titanium with relatively less expensive Fe impurities to reduce manufacturing costs.

17. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko--Chen--Thompson as applied to claims 38-40 above in view of Applicant's admitted prior art. As explained above, these references teach multicolor LED primary light sources including primary light sources that emit UV and blue; substrates doped with secondary re-emission centers; and

Chen teaches that UV and blue light can be used for causing secondary light emission in various inorganic phosphors. Regardless of whether any of these references specifically disclose yellow downconverter phosphors that re-emit in response to blue light, Applicant acknowledges that this was previously known (see Background of the Invention, discussing various conventional blue-LED yellow-phosphor devices such as that of Nichia).

a. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide this specific combination of primary and secondary light sources for the purpose of obtaining a warmer white color, and depending only on well known considerations such as (1) a weighing of the availability and manufacturing costs associated with providing multiple dopants in a substrate vs. the manufacturing time and cost of providing additional active layers in the LED vs. the cost of providing phosphors in the chip's encapsulant; (2) a weighing of the relative light emission efficiencies produces by these options; and a comparison of the device's long term stability/degradation associated with each of these three options and the result it would have on time-dependent color shifting. Restated, all of the claimed components/features were known, their individual characteristics were well understood, the alteration of these characteristics produce changes in a well understood manner (e.g., increasing impurity concentrations in the substrate or phosphor increases primary light absorption and secondary re-emission), and the combination of these individual features does not produce any unexpected results.

Response to Arguments

18. Applicant's arguments filed 11/30/2001 have been fully considered but they are either moot in light of the new grounds of rejection or are not persuasive.

a. Applicant has argued the differences between the present invention as described in the specification and the Kaneko device and the benefits of the former (see REMARKS paper #11), but has not set forth any arguments as to why the reference does not anticipate the present invention, as claimed.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Mueller-Mach et al. '3233 teaches light emitting devices that includes LEDs, phosphor layers and substrates doped with secondary re-emission centers. While this PG-Pub document was filed on Aug 28, 2001, it is a CIP of application 09/407,228, filed 9/27/99.

b. Matsubara et al. '536 teaches II-VI LEDs formed on ZnSe substrates that are doped for secondary re-emission.

c. Weber et al. '213 teaches two-color LED arrays wherein a portion of some of the light of one of the LED colors (blue) is converted to a third color for a full-color RGB display.

d. Kimura et al. '552 teaches multicolor LEDs having R, G and B active layers formed in a stack.

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

INFORMATION ON HOW TO CONTACT THE USPTO

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister,** at **(703) 306-9165.** The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B. William Baumeister
April 27, 2002

EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800